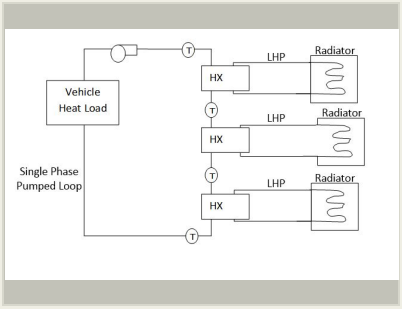
Variable Heat Rejection Loop Heat Pipe radiator, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

Thermal control systems are sized for the maximum heat load in the warmest continuous environment. This design process results in a larger radiator surface area than is needed for portions of a mission where the heat load is lower or the environment is colder. Now that NASA is refocusing its human missions to the much colder areas of exploration beyond Low Earth Orbit (LEO), the need for a variable heat rejection thermal control system increases. This SBIR project by ACT will develop a Variable Heat Rejection multi Loop Heat Pipe (VHR/mLHP) Radiator where the variable heat rejection feature will be provided by independently controlling the heat load for each LHP by heating and cooling the compensation chamber The proposed approach will use a series of individually controlled loop heat pipes (LHPs) receiving heat from a single phase pumped loop to perform the function of variable heat rejection while still closely controlling the loop setpoint temperature. This technology development effort has three main objectives that build on mature LHP technology: optimization of the liquid/LHP heat exchanger, investigation of the use of heaters or thermoelectrics for temperature control and shutdown of the individual LHPs, and characterization of the system performance when multiple LHPs are assembled in series. The purpose of this program is to develop a holistic approach for a variable heat rejection system design consisting of multiple heat exchangers and multiple individually controlled LHPs which can achieve high turn down ratios for variable heat rejection while increasing the system reliability and reducing the system power and mass. The proposed concept is flexible, as various configurations could be obtained to meet different mission parameters. The main advantage of this technology development effort is that it leverages already proven technologies to integrate a novel system that can achieve robust variable heat rejection.



Variable Heat Rejection Loop Heat Pipe radiator Project Image

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Small Business Innovation Research/Small Business Tech Transfer

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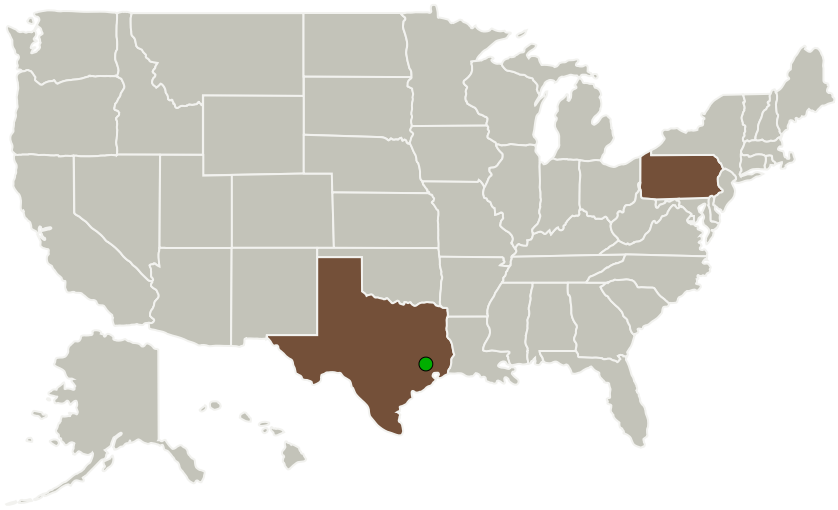
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Advanced Cooling Technologies, Inc.	Lead Organization	Industry	Lancaster, Pennsylvania
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Pennsylvania	Texas

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137720)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Advanced Cooling Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

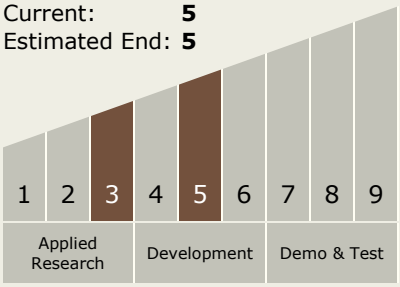
Carlos Torrez

Principal Investigator:

William Anderson

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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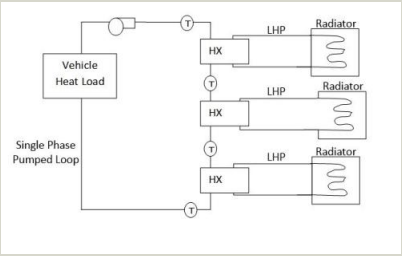
Images



Project Image
Variable Heat Rejection Loop Heat Pipe radiator Project Image
(https://techport.nasa.gov/image/137022)

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.3 Heat Rejection and Storage

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System